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NEW SPECIES OF CHIGGERS FROM KOREA
(ACARINA, TROMBICULIDAE)[1]

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During studies on the possible etiology and transmission of hemorrhagic fever in Korea, an intensive collection of chiggers was made from small mammals, primarily rodents, by the Field Unit of the Commission on Hemorrhagic Fever of the Armed Forces Epidemiological Board in 1953 and 1954, and by its predecessor in 1952, a special Research Team of the Armed Forces Epidemiological Board. As a result of these investigations, eight new species of trombiculid mites were discovered and the larvae of these are described and illustrated in this paper. The possible role of these chiggers in the epidemiology of hemorrhagic fever, and observations on the host relationships and seasonal variations in incidence, are presented elsewhere (Traub *et al.*, 1954).

Trombicula (Leptotrombidium) gemiticula, n. sp.
(Figs. 1-7)

Diagnosis.—Nearest to *T.* (*L.*) *palpalis* Nagayo *et al.*, 1919, and *T.* (*L.*) *orientalis* Schluger, 1948, in general shape of scutum and in having both the dorsal and ventral tibial setae branched. Separable from *T.* (*L.*) *palpalis* in that it has a larger scutum, *i.e.*, *PW*[5] about 80 instead of 65 microns, and longer scutal setae (*i.e. PL* 52 instead of 47 microns). Differs from *T.* (*L.*) *orientalis* in having more dorsal setae, about 45 instead of 28-32, and these setae, as well as the scutal setae, are shorter and less bushy.

Description.—**Body:** Ovate to subovate, 357 x 224 microns in fairly engorged holotype. Eyes paired, subequal, and at level of insertion of *PLs.* **Gnathosoma:** Chelicerae about 4 times as long as broad at base, with apical tricuspid cap.

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[5]A key to the abbreviations used in this paper appears in "A Manual of the Chiggers" by G. W. Wharton (1952, Memoir No. 4, Entomological Society of Washington).

Cheliceral bases, palpal coxa and femora punctate. Setae on palpal femur and genu nude; the dorsal and ventral setae on palpal tibia branched; lateral seta nude. Palpal formula therefore *N/N/BNB*. Galeal and maxillary (palpal coxa) setae branched, pectinate. Palpal tarsus with 6, at times 7, branched setae and a basal striated rod. Palpal claw 3-pronged. **Scutum:** About 1¾ to twice as broad as long. Anterior margin relatively straight. Lateral margins concave between insertions of *ALs* and *PLs*. Some specimens, where *A-P* is larger, with lateral margins almost straight. Posterior margin slightly sinuate, appearing almost evenly and shallowly convex. With *PLs* set well anterior on rounded shoulders, at level with sensillae bases. Scutum lightly micropunctate except around insertion of *AM*. Scutal setae fairly stout with conspicuous barbs. Sensillae flagellate, with very minute barbs for proximal ⅓ to ½, and then distally conspicuously branched. A darkened ridge contiguous and anterior to each sensillae base.

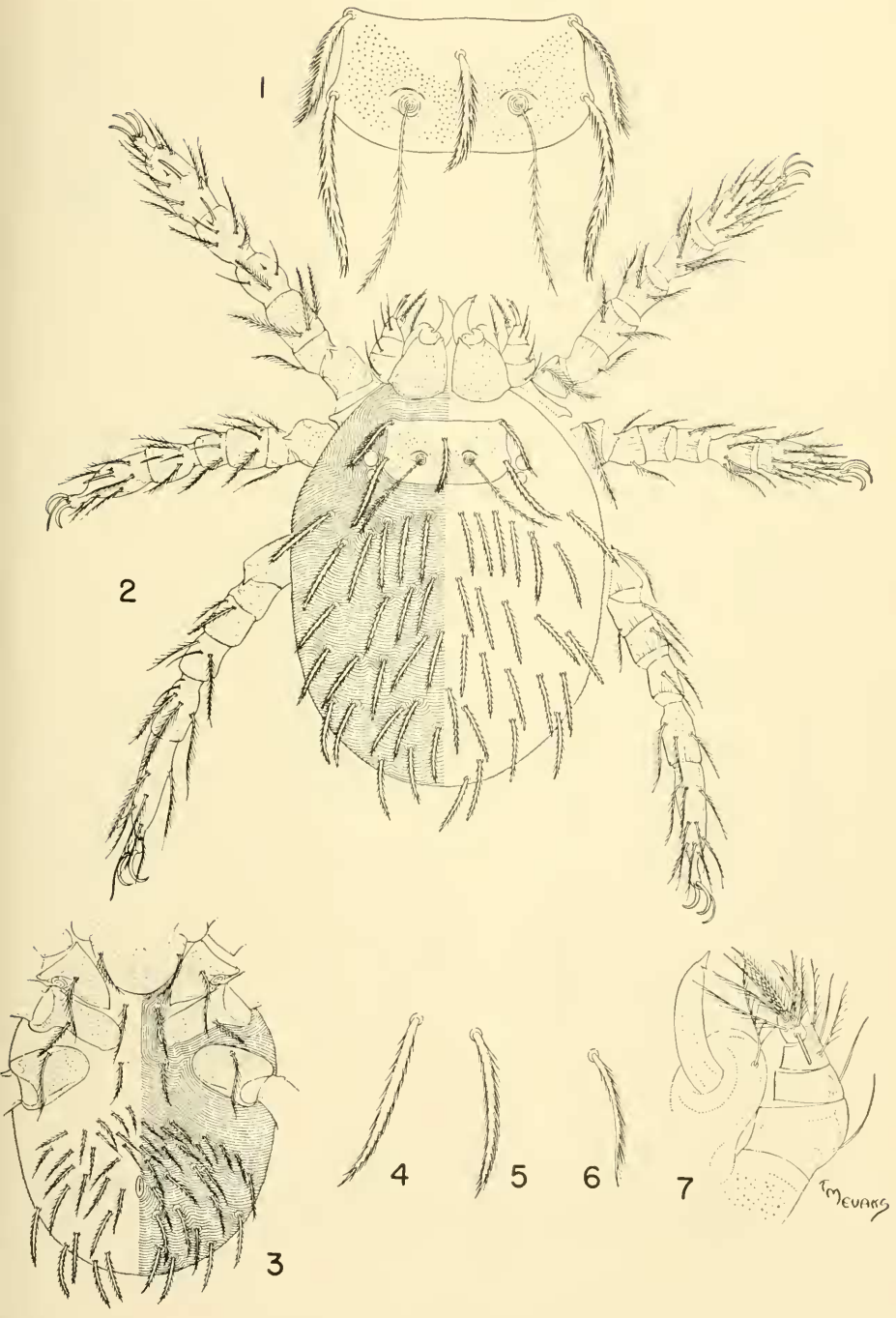
STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (RT B-25912-1)	69	79	34	25	16	20	44	39	53	39 -54	79/58 = 1.36	79/41 = 1.93	3.16	1.18
Paratypes (20) Mean	70	80	33	28	17	23	47	39	52	38 -54	1.32	1.85	2.91	1.18
Range (+or—)	3	3	3	3	2	4	5	3	3		0.13	0.22	0.28	0.07

Body Setae: Dorsal setae resemble those of scutum; 43 to 49 in number; somewhat irregular in arrangement but rows frequently 2-12-8-10-8-4-2. Two pairs of pectinate sternal setae; one pair between coxae I and second pair between coxae III. Ventral setae about 46 in number, of which about 12 are postanals. True ventrals 30 microns long; subpectinate. **Legs:** Coxae and legs punctate dorsally and ventrally. All coxae unisetose; on coxa I, seta median; on coxa II, ventromarginal; on coxa III anteromarginal or slightly submarginal. Sensory setae as follows: Leg I with 2 genualae, a microgenuala, 2 stout tibiala, a microtibiala, tarsal spur, microspur, a subterminala, a parasubterminala, and a pretarsala. Leg II with a genuala, 2 tibiala, a tarsal spur and microspur, a pretarsala. Leg III with a genuala and a tibiala.

Type Material.—Holotype (RT B-25912) *ex Apodemus peninsulae*, Korea, Munsan-ni, 6 November 1953, coll. by Field Unit of the Commission on Hemorrhagic Fever. The following paratypes and other collections all from same source in Korea: *ibid*, but *ex Apodemus agrarius;* 48 *ex Apodemus agrarius*, Yangwon -ni, 30 miles N. of Seoul (Commonwealth Division Area)—of these, 29 on 17 October 1953, 17 on 7 November 1953, 1 on 17 February 1954, and 1 on 29 April 1953.

T.(L.) gemiticula, n. sp. Fig. 1, scutum; fig. 2, dorsal view of chigger (with ventral aspect of legs); fig. 3, ventral view of chigger (with ventral aspect of legs); fig. 4, humeral seta; fig. 5, dorsal seta; fig. 6, ventral seta; fig. 7, ventral view of gnathosoma.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Holotype (U.S.N.M. No. 2230), and 7 paratypes in collections of U. S. National Museum, remaining paratypes distributed amongst: British Museum (Natural History), the South Australian Museum at Adelaide, the Rocky Mountain Laboratory of the U. S. Public Health Service, the Chicago Natural History Museum, the Colonial Office Research Unit at Kuala Lumpur, the Department of Entomology at the University of Kansas, the Department of Zoology at the University of Maryland, the Muséum Nationale d'Histoire Naturelle at Paris, the Department of Parasitology, Institute for Infectious Diseases of the University of Tokyo, and the collections of Dr. E. W. Jameson, Dr. Charles Radford, and the authors.

Trombicula (Leptotrombidium) zeta, n. sp.
(Figs. 8-16)

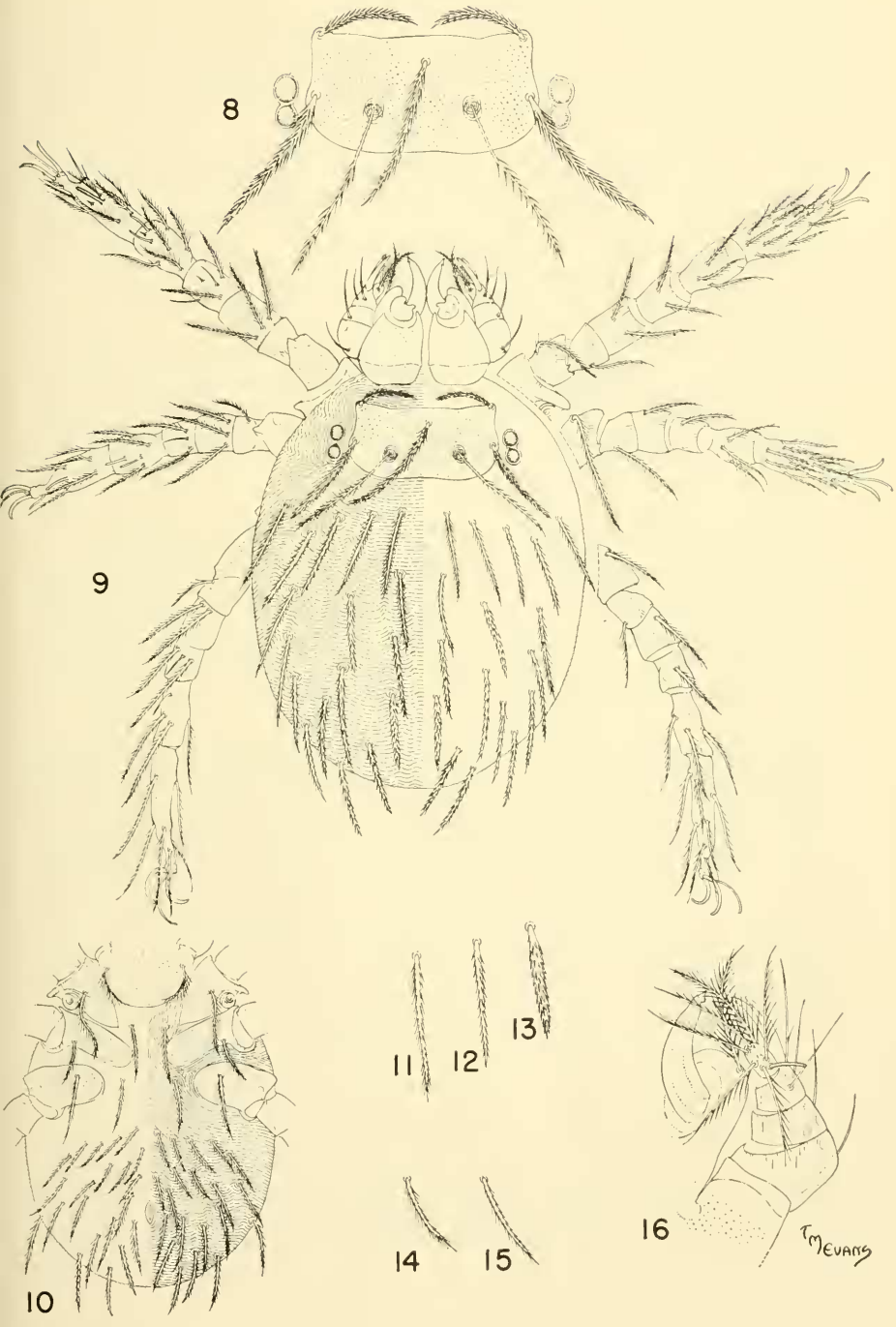
Diagnosis.—Agrees with *T. (L.) subintermedia* Jameson and Toshioka, 1954, regarding number of dorsal setae (32-36), palpal setal formula (*N/N/bNN*), and submedian insertion of seta on coxa III. Separable in that the scutum is consistently broader—*PW* about 91 microns instead of 80, and 1.75 times as broad as long instead of about 1.6 times; with its lateral margins only slightly concave so that scutum appears almost rectangular instead of sides appearing emarginate; *PL* setae longer, about 72 microns in length instead of 63.

Description.—**Body:** Subovate, 334 × 232 microns in slightly engorged holotype. Eyes paired, subequal in size or anterior one a little larger; at level of *PLs*. **Gnathosoma:** Chelicerae about 4 times as long as broad at base, with apical tricuspid cap. Palpal formula *N/N/bNN*. Galeal and palpal coxal (maxillary) setae heavily plumose, barbs quite long. Palpal tarsus with 6 branched setae and a striated rod. Palpal claw 3-pronged. **Scutum:** One and three-fifths to 1¾ times as broad as long. Anterior margins slightly sinuate, convex in middle above insertion of *AM*. Lateral margins somewhat concave between *ALs* and *PLs*. Posterior margin straight or slightly concave near middle. *AL* setae at anterolateral angles of scutum. *PLs* set well anterior to caudal margin of scutum, but distinctly posterior to imaginary midline; inserted slightly anterior to level of sensillae bases. Scutum lightly micropunctate except around insertions of *AM* and posterior to sensillae bases. Scutal setae fairly stout; plumose. Both *AM* and *PLs* long, about 70 microns. Sensillae flagellate proximally, this portion appearing smooth but actually, when seen under oil, with minute barbs; branched for distal two-thirds.

STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (B-25897-1)	81	88	38	35	21	26	75	46	77	67 -74	88 —=1.35 65	88 —=1.57 56	2.51	1.05
Paratypes (20) Mean	85	91	41	35	21	27	71	44	72	64 -78	1.31	1.65	2.67	1.19
Range (+or—)	5	6	4	4	2	4	5	4	6		0.05	0.13	0.31	0.14

T.(L.) zeta, n. sp. Fig. 8, scutum; fig. 9, dorsal view of chigger (with ventral aspect of legs); fig. 10, ventral view of chigger; fig. 11, humeral seta; fig. 12, dorsal seta; fig. 13, dorsal seta; fig. 14, preanal seta; fig. 15, postanal seta; fig. 16, gnathosoma.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Body Setae: Dorsal setae resembling scutal setae; as long as *AM* and *PLs;* 32-36 in number generally arranged 2-8-6-6-6-4-2. Two pairs of sternals followed by 40-42 ventral setae, of which 12 are postanals. True ventrals 35-37 microns long; pectinate or somewhat shaggy. **Legs:** All coxae unisetose; seta on coxa III submarginal, almost median. Sensory setae as in *T.(L.) gemiticula,* n. sp.

Type Material.—Holotype and paratypes (B-25897) *ex Apodemus agrarius,* Korea, Munsan-ni, 6 November 1953, coll. Field Unit of the Commission on Hemorrhagic Fever. All paratypes from Korea and with same collector, as follows: 7 *ibid;* 6 *ex Apodemus agrarius,* Kumhwa, 2 December 1953; 18 *ex Apodemus agrarius,* Taehoesan-ni, with collecting data as follows—three 18 December 1953, three 19 December 1953, six 20 February 1954, one 19 February 1954, four 6 April 1954, and one 7 April 1954; 23 *ex Apodemus agrarius,* Yangwon-ni (Commonwealth Division Area) 30 miles N. Seoul, 8 of these 29 December 1953, eight 3 March 1953, and seven 21 March 1953. Holotype (U.S.N.M. No. 2232), deposited in collections of U. S. National Museum, and paratypes distributed as for *T. (L.) gemiticula,* n. sp.

Comment.—This species of chigger was found primarily in the winter and spring, particularly on *Clethrionomys* on Hill 1468, near Kapyong and Kumhwa. When *T. zeta* was found on *Apodemus agrarius,* the largest collections were from Commonwealth Division Area or Yangwon-ni, Saemal, Yongp'yong 16 miles South of Ch'orwon, Kumhwa, Munsan-ni, Taehoesan-ni 12 miles South of Ch'orwon, and Nop'a-dong, 7 miles Northwest of Munsan-ni.

Discussion.—Since *T.(L.) zeta* closely resembles *T.(L.) subintermedia,* and the two are separated by the size of the scutum and length of *PLs,* it is advisable to consider the possibility that both names really merely represent extremes in the sizes and representatives of the same species. If this were true, then the mean of the measurements of the *PWs* or *PLs* in a long series would in each instance fall near the midpoint of the two extremes, producing a typical bell-shaped curve when plotted as a graph. In actuality, however, the measurements of 200 specimens resulted in a bimodal curve—a bell-shaped curve for the *PW* or *PL of T.(L.) zeta* and another for the *PW* or *PL* of *T.(L.) intermedia,* with the lower measurements of the former species overlapping the upper extremes of the latter. Further, the presence of a broad scutum was invariably correlated with long *PL* setae. Biologic data support the contention that these are two distinct species. For example, *T. (L.) zeta* comprised almost half of the chiggers collected during the winter months by the research teams studying hemorrhagic fever. One third of all the *T.(L.) zeta* were found in January and February (Traub, et al., *in prep.*). On the other hand, *T.(L.) subintermedia* was common during the spring—three-fourths of the specimens having been collected in April and

May, and less than 4 per cent having been taken in the winter (Traub, et al., *in prep.*). It is estimated that more than one-third of the *T.* (*L.*) *zeta* occurred on the striped field mouse, *Apodemus agrarius*, but that nearly 60 per cent parasitized the red-backed vole, *Clethrionomys*. In contrast, over 90 per cent of the *T.*(*L.*) *subintermedia* were taken on *Clethrionomys*. Geographical differences in distribution were also noted, and the new species was rarely collected south of the 38th parallel, such as at the National Forest near Seoul, where *T.*(*L.*) *subintermedia* was common.

Trombicula (Leptotrombidium) tecta, n. sp.

(Figs. 17-24)

Diagnosis.—Separable from all known Korean *Leptotrombidium* in having a 4-pronged palpal claw. Nearest to *Trombicula* (*Leptotrombidium*) *tosa* Sasa and Kawashima, 1951, (from Japan) in size and general shape of scutum. Separable by the length of the dorsal setae, which have a maximum size of 72 microns instead of 60 as in *T.*(*L.*) tosa, and with *A-P* 25, not 22.

Description.—**Body:** Subovate, 285 x 188 microns in partially engorged holotype. Eyes paired, about equal, at level of *PLs*, about 2 microns from scutum.

Gnathosoma: Chelicerae quite curved; about 5 times as long as broad at base, with an apical tricuspid cap. Palpal formula sequence *N/N/BNN*. Galeal and palpal coxal (maxillary) setae branched. Palpal tarsus with 7 branched setae and a basal striated rod. Palpal claw 4-pronged, the proximal prong smallest.

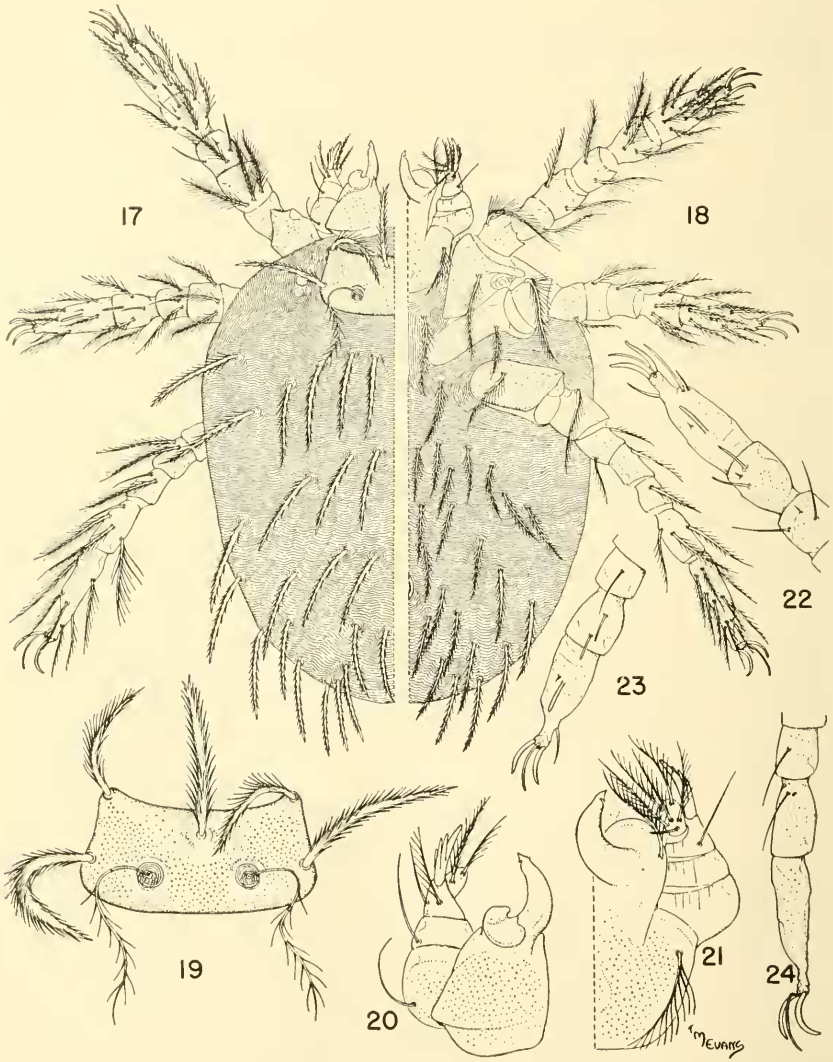
Scutum: Anterior margin straight or slightly sinuate, lateral margins fairly straight anterior to insertion of *PLs*. Posterior margin essentially straight. *ALs* inserted in "shoulders" at anterolateral angles. *PLs* distinctly removed forward so that they are a short distance (2-3 microns) anterior to level of sensillae bases; *PLs* not inserted in distinct shoulders. Scutum lightly punctate except around *AM* and posterior to sensillae bases. Scutal setae quite long, thick, with numerous stout barbs arising from all sides of the shaft. *PLs* about half again as long as *ALs*. Sensillae flagellate, proximal half of basal third with small inconspicuous barbs; distally with fine branches.

Standard Measurements in Microns

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (RT B-30998-7)	70	75	34	32	14	26	59	39	63	58	78 / —— = 1.24	1.63	2.34	1.12
Paratypes (11)										-70	63			
Mean	68	77	34	31	14	25	57	40	62	58 -72	1.23	1.69	2.46	1.14
Range	6	5	3	1	1	2	3	3	4		0.07	0.10	0.17	.08

Body Setae: Dorsal setae resembling *PLs* in size and structure: 40 to 46 in number and arranged typically 2-10-8(10)-8-6(8); remaining rows with variable numbers. Two pairs of sternal setae 40-45 microns long; with long, very slender

barbs. Ventral setae about 46 to 48 in number, of which about 16 are postanals. First row of ventral setae 35 to 40 microns but the setae get progressively longer toward the posterior end of the chigger. **Legs:** Coxae and legs punctate. The seta on 3rd coxa submarginal. Sensory setae as in all above-described *Leptotrombidium*.



T.(L.) tecta, n. sp. Fig. 17, dorsal view of larva; fig. 18, ventral view of larva; fig. 19, scutum; fig. 20, gnathosoma (dorsal); fig. 21, gnathosoma (ventral); fig. 22, leg I (distal segments); fig. 23, leg II (distal segments); fig. 24, leg III (distal segments).

Type Material.—Holotype and 27 paratypes (RT B-30998, L 541030-5 and 6) *ex* a pool of *Apodemus agrarius* and *Microtus fortis pelliceus*, Korea, Chip'o-ri, 30 October 1954, Field Unit of the Commission on Hemorrhagic Fever. Other paratypes as follows: 2 cultured in the laboratory from chiggers taken *ex Apodemus agrarius*, Chip'o-ri, 30 October 1954, coll. as above; 4 cultured in the laboratory from chiggers taken on *Microtus fortis pelliceus*, Chip'o-ri, date and collector *ibid;* 19 raised in the laboratory on white mice, 6 from mouse No. 23, 8 from mouse No. 35, 1 from mouse No. 37, 3 from mouse No. 39, and 1 from mouse No. 58.

Holotype (U.S.N.M. No. 2231) deposited in the U. S. National Museum and paratypes distributed as for *T.(L.) gemiticula*, n. sp.

Trombicula (Leptotrombidium) pumilis, n. sp.

(Figs. 25-32)

Diagnosis.—Superficially resembles *Trombicula (Leptotrombidium) subintermedia* Jameson & Toshioka, 1954, but differs as follows: Scutum smaller (PW 69 microns instead of 80); the posterolateral corners of the scutum somewhat obtuse, not fully and evenly rounded; posterior margin distinctly sinuate; with fewer dorsal setae (27-32 instead of about 36).

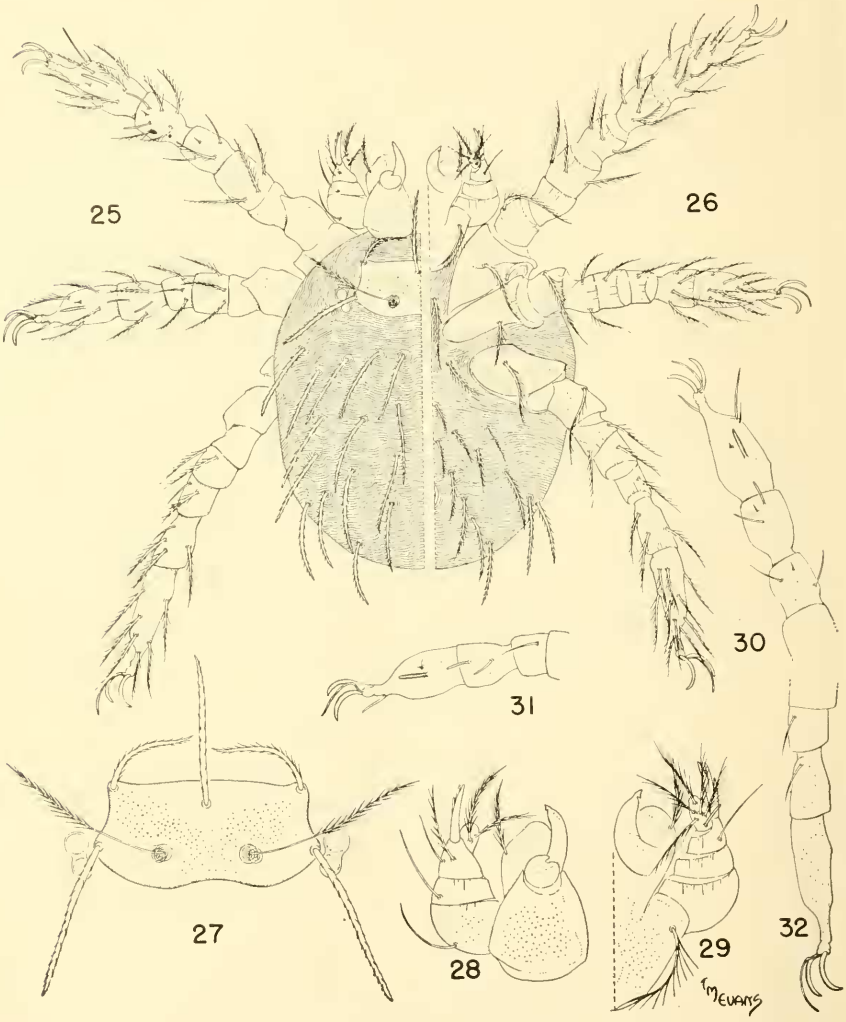
Description.—**Body:** Small, subovate, 228 x 158 microns in holotype. Eyes double, subequal in size, at level of *PLs* and only 1 micron distant from scutum. **Gnathosoma:** Chelicerae about 3 to 4 times as broad as long at base, with apical tricuspid cap. Palpal formula *N/N/BNN*. Galeal setae branched, pectinate. Palpal tarsus with 7 branched setae and a basal, striated rod. Palpal claw 3-pronged. **Scutum:** Nearly twice as broad as long. Anterior margin relatively straight. Lateral margins slightly concave. Posterior margin biconvex. *PLs* inserted just slightly anterior to posterior margin and on a level with sensillae bases. *AM* and *PL* setae quite stout barbs. Scutum micropunctate except around and anterior to *AM* and posterior of *PLs* and sensillae bases. Sensillae flagellate, nude at proximal fourth or third; remainder plumose.

Standard Measurements in Microns

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (B-28082)	60	68	29	23	12	20	48	31	54	44	68 / 53 = 1.28	1.94	2.96	1.19
										-47				
Paratypes (10) Mean	58	69	29	26	12	20	47	32	55	43	1.25	1.81	2.65	1.16
										-50				
Range (+or—)	2	4	4	3	0	1	3	3	3		0.11	0.16	0.31	0.05

Body Setae: Dorsal setae resembling scutal setae; thin, barbs mostly adpressed, short, 27 to 32 in number arranged typically 2-8(-7-10)-6-6-6(4)-2. Two pair of pectinate sternal setae; first pair longer. Ventral setae about 25 in number with about 6 of these postanals. Typical ventrals, as found in first 2 rows, 28 microns long. **Legs:** Coxae all unisetose. Seta on 3rd coxa submarginal in position. Sensory setae as in above described species.

Type Material.—Holotype and 59 paratypes (Rt B-28082-84) *ex* three chipmunks, *Eutamias sibiricus* (Laximann), Korea, Central National Forest 20 miles North of Seoul, 18 April 1954, coll. Field Unit of the Commission on Hemorrhagic Fever. Seventeen paratypes *ibid*,



T.(L.) pumulis n. sp. Fig. 25, dorsal view of larva; fig. 26, ventral view of larva; fig. 27, scutum; fig. 28, gnathosoma (dorsal); fig. 29, gnathosoma (ventral); fig. 30, Leg I (distal segments); fig. 31, Leg II (distal segments); fig. 32, leg III (distal segments).

but collection dates as follows—one 9 October 1954, five 29 May 1954, seven 27 March 1953, two 13 April 1953, one 5 September 1953; 5 *ex Apodemus peninsulae, ibid,* 31 July 1953; 1 ex *Micromys minutus,* 5 miles South of Munsan-ni, 5 May 1953; 31 *ex* a bat, (*Myotis* sp.?), Uijongbu Mountains, about 13 miles North of Seoul, 31 July 1952; 1 *ex* a bird, presumably *Parus major wladiwostokensis,* 16 April 1954; 1 *ex Apodemus peninsulae,* Sangbonch'on-ni, 17 miles Southeast of Seoul, 14 April 1954.

Holotype (U.S.N.M. No. 2233) deposited in U. S. National Museum and paratypes distributed as for *T.* (*L.*) *gemiticula,* n.sp.

Trombicula (Leptotrombidium) halidasys, n. sp.

(Figs. 33-40)

Diagnosis.—Resembles *T.*(*L.*) *miyazakii* Sasa *et al.,* 1952, and *T.*(*L.*) *owuensis* Sasa *et al.,* 1952, regarding size of scutum, although differing in general configuration, and in having 7 branched setae on palpal tarsus. Differs further from these two described species in that there are far more setae, 85 to 100, instead of about 45 as in *T.*(*L.*) *miyazakii* or 56 as in *T.*(*L.*) *owuensis.* The dorsal setae are shorter with longer and heavier barbs, (in this respect resembling the dorsal setae of *T.*(*L.*) *pallida* Nagayo *et al.,* 1919).

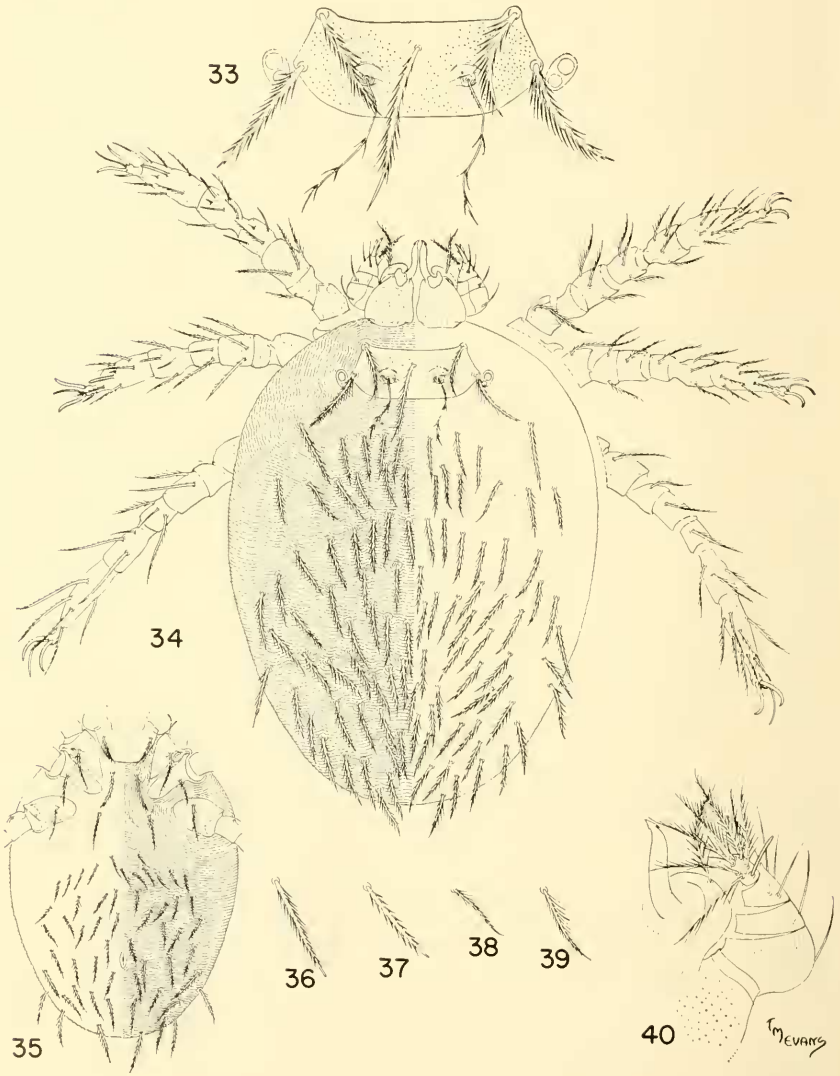
Description.—**Body:** Ovate, 425 x 306 microns in engorged holotype. Eyes double; anterior one twice as large as posterior eye; at level of *PLs.* **Gnathosoma:** Chelicerae 3½ to 4 times as long as broad near base, with apical tricuspid cap. Palpal setal formula *N/N/BNN.* Galeal seta branched with long pectinate barbs. Palpal tarsus with 7 branched setae and a basal striated rod. Palpal claw 3-pronged. **Scutum:** Usually twice as broad as long; anterior margin straight until near lateral margins where it slopes anteriorly at insertions of *ALs,* forming "shoulders." Lateral margins straight but declivous, sloping lateral toward *PLs.* Posterior margin straight or slightly sinuate except where curving anteriorly towards *PLs,* which are set in shoulders slightly anterior to level of sensillae bases. Lightly punctate except around insertion of *AM.* Scutal setae quite stout; *ALs* and *PLs* heavily branched. *AM* seta longest of scutal setae, pinnae resembling those on *ALs* and *PLs* but usually more appressed. Sensillae thin and fragile, present on only 1 or 2 of the 50 specimens known. Proximal third with small barbs; distal ⅔ very sparsely branched.

STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (B-25928-5)	88	106	45	33	17	24	76	48	59	48	106	2.12	3.42	1.52
											1.48	2.09	3.22	1.50
										-52	——=1.45			
Paratypes											74			
Mean	86	108	45	34	18	26	74	51	61	39 -60				
Range	6	6	5	2	2	3	7	7	6		0.11	0.22	0.42	0.08

Body Setae: Dorsal setae resembling scutal setae in structure, with same stout pinnae but shorter in length, 85 to 105 in number; arranged very irregularly, the rows generally commencing 2-8-12-10. . . . Two pairs of sternal setae. Ven-

tral setae about 60 in number, of which about 16 are postanals. True ventrals 28-30 microns long; subpectinate. **Legs:** All coxae are unisetose. Seta on coxa III is submarginal. Sensory setae as in *T.(L.) gemiticula*, n. sp.



T.(L.) halidasys, n. sp. Fig. 33, scutum; fig. 34, dorsal view of larva (with ventral aspect of legs); fig. 35, ventral view of larva; fig. 36, humeral seta; fig. 37, dorsal seta; fig. 38, preanal seta; fig. 39, postanal seta; fig. 40, gnathosoma (dorsal).

Type Material.—Holotype and 42 paratypes (RT B-25928) *ex Apodemus agrarius*, Korea, Commonwealth Division Area or Yangwon-ni, 30 miles North of Seoul, 7 November 1953, coll. Field Unit of the Commission on Hemorrhagic Fever. Three paratypes from 2 shrews, *Crocidura suaveoleus*, *ibid*, 30 and 31 March 1954; 1 *ex* same host, Ori-dong, 35 miles North of Seoul, 16 December 1952; 4 *ex Crocidura suaveoleus*, 7 miles Northwest of Munsan-ni, Nop'a-dong, 24 February 1954; 1 *ex* soil sample, Tokkum-ni, 4¼ miles North of Yonch'on, 25 March 1954.

Holotype (U.S.N.M. No. 2234) deposited in U. S. National Museum, and paratypes distributed as for *T.(L.) gemiticula* n.sp.

Euschöngastia (Laurentella) arcaricola, n. sp.
(Figs. 41-48)

Diagnosis.—Nearest to *Euschöngastia kitajimai* Fukuzumi and Obata, 1953, which was described from *Rattus rattus* in Japan but is also found on chipmunks in Central Korea. Differs from *kitajimai* in having fewer dorsal setae (± 30 instead of ±40). The scutum of the new species is narrower although the length is the same, thus making the *PW/SD* ratio ± 1.44 instead of ± 1.26. With the posterior margin of the scutum sinuate near *PLs* instead of being evenly convex as in *E. kitajimai*, and not extending as far caudad.

Description.—**Body:** Subovate in engorged holotype, 339 x 232 microns. Eyes paired, anterior eye larger than posterior one. Anterior eye at level of sensillae bases. **Gnathosoma:** Chelicerae about 5 times as long as broad near base; with apical triscuspid cap bearing a distinct lateral proximal tooth. Cheliceral bases, palpal coxa and femora punctate. Palpal formula *B/B/bbb;* however branches on genual seta, dorsal and ventral tibial setae usually appressed or broken off. Galeal seta nude. Palpal coxal (maxillary) seta with 4 to 5 branches. Palpal tarsus with 6 branched setae and a basal striated rod. Palpal claw 3-pronged. **Scutum:** Evenly micropunctate except just posterior to *AM*. Anterior margin nearly straight between shoulders. *AM* marginal in insertion. *ALs* set back about 12 microns from anterior margins of shoulders. Lateral margins slightly to distinctly concave between *ALs* and *PLs*. Posterior margin sinuate, in many cases actually biconvex. *PLs* inserted at posterior corners of scutum. Sensillae bases slightly closer to *ALs* than to *PLs*. Distinct ridges over sensillae bases. Sensillae clavate, about 32 microns long (including petiole) x 10 microns wide. Scutal setae slender with short appressed barbs.

STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (B12069-4)	48	61	24	22	21	24	28	19	31	29-31	61/46 = 1.32	1.42	2.80	1.39
Paratypes (11) Mean	48	61	25	23	19	23	28	20	31	27-31	1.38	1.44	2.71	1.39
Range (+or—)	3	8	2	2	3	2	3	3	5		0.09	0.16	0.29	0.12

Body Setae: Dorsal setae resembling scutal setae; 29 to 31 in number, usually arranged 2-8-6-6-6-. Two pairs of sternal setae; 1st pair inserted at level of apices of coxae 1; 2nd pair inserted between coxae III; short, thin, with appressed barbs. Ventral setae 30-34 in number, of which about 8-10 are postanals. True ventrals 19 microns long, but posterior ones slightly longer; caudomarginal ones same length as dorsal setae. **Legs:** Coxae and legs with small punctae. All coxae unisetose. Seta on coxa I medial. Seta on coxae II near middle of posterior sclerotized margin. Seta on coxa III median. Sensory setae of legs as follows: Leg I with 3 genualae, a microgenuala, 2 stout tibialae, a microtibiala, tarsal spur, microspur, a subterminala, parasubterminala, and pretarsala. Leg II with a genuala, 2 tibialae, tarsal spur, microspur and pretarsala. Leg III with a genuala, a tibiala, and a mastitarsala.

Type Material.—Holotype and 13 paratypes (Rt B-12069) *ex* chipmunk, *Eutamias sibiricus* (Laxmann), Korea, Central National Forest, 20 miles N. of Seoul, 26 August 1952, coll. Field Unit of the Commission on Hemorrhagic Fever; 11 paratypes, (B-12068), *ibid;* 17 paratypes *ibid*, but 4 September 1952.

Holotype (U.S.N.M. No. 2235) deposited in U. S. National Museum, and paratypes distributed as for *T.(L.) gemiticula,* n.sp.

Comment.—This species, as with *E. kitajimai*, is a member of the *indica*-group which has now been revised as a subgenus, *Laurentella,* by Audy (1956). It is therefore in order to refer to this species as *Euschöngastia* (*Laurentella*) *arcaricola.*

Gahrliepia (Walchia) comataxilla, n. sp.
(Figs. 49-56)

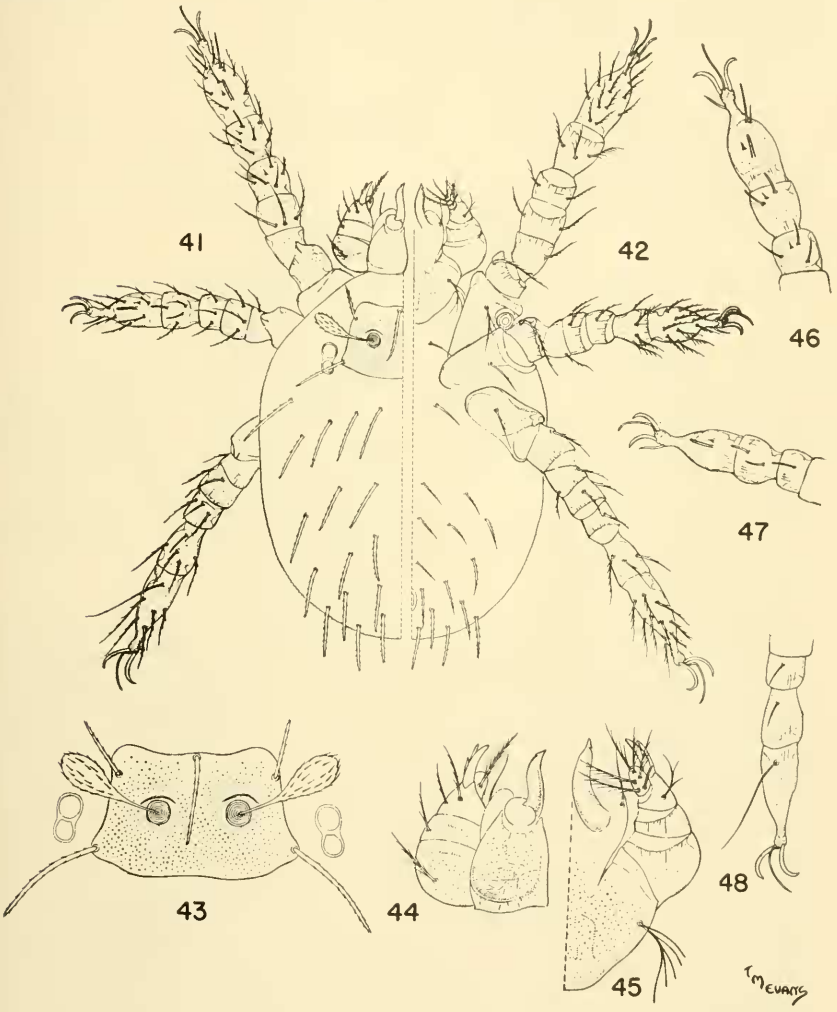
1954. *Gahrliepia* (*Walchia*) *brennani* var. *ventralis* Jameson and Toshioka *nec.* Womersley, 1952, *err. det.*, Pacific Science 8:12-14 (Fig. 1).

1954. *Gahrliepia* (*Walchia*) *brennani ventralis* Traub *et al., nec.* Womersley, 1952, *err. det.*, Amer. Jour. Hyg. 59 (3):300.

Diagnosis.—A Korean species which is close to *G.(W.) ventralis* (Womersley, 1952) (new status) from Malaya, and like it, unique in that there are 2 or 3 ventral setae inserted immediately anterior and lateral to coxa III. Further agreeing with *G.(W.) ventralis* in that there are 2 humeral setae per side. Separable from *G. (W.) ventralis* as follows: *PLs* merely subequal to *ALs* in length instead of being much longer than *ALs* i.e., half again as long. Coxa II scarcely greater than *PW*, so that the ratio $\frac{PW}{\text{Coxa II}}$ is approximately 0.91, while in *(W.) ventralis PW* is only about two-thirds or three-fourths the length of coxa II, and the resulting ratio is about 0.74. *AW* and *PW* significantly greater (44 and 50 microns) than in *(W.) ventralis* (34 and 45 microns), but *PSB* virtually identical (49 versus 47 microns). The scutum is therefore proportionately broader in the new species.

Description.—**Body:** Subovate, but constricted above midpoint in greatly engorged holotype, which is 512 x 314 microns. Eyes absent. **Gnathosoma:** Chelicerae about 3½ or 4 times as long as broad; with a typical tricuspid cap. Papal

setal formula *N/N/NNN*. Palpal thumb with 4 plumed setae. Palpal claw 3-pronged, the middle prong the longest. **Scutum:** About two-thirds as broad as long (50 x 75 microns); shield-shaped, with anterior margin slightly concave; lateral margins sloping from *ALs* towards *PLs;* margins beyond *PLs* fairly straight and sloping mesads at an angle of about 45°, the resulting triangle with



Euschongastia (*L.*) *arcaricola*, n. sp. Fig. 41, dorsal view of larva; fig. 42, ventral view of larva; fig. 43, scutum; fig. 44, gnathosoma (dorsal); fig. 45, gnathosoma (ventral); fig. 46, leg I (distal segments); fig. 47, leg II (distal segments); fig. 48, leg III (distal segments).

an altitude (*PP*) which almost equals *A-P*. Uniformly micropunctate. *AL* setae at anterolateral angles of scutum, but corners evenly rounded and "shoulders" therefore absent. *AL* setae fairly well branched; resembling *PLs* in structure and length. *PLs* marginal, inserted at level slightly below midpoint of scutum. *SB* inserted at line midway between *ALs* and *PLs;* removed from lateral margins of scutum for a distance equal to their diameters. With a faint ridge anterior to each sensillary base. Sensillae of typical clavate pattern; the expanded portion about 2½ times as long as broad.

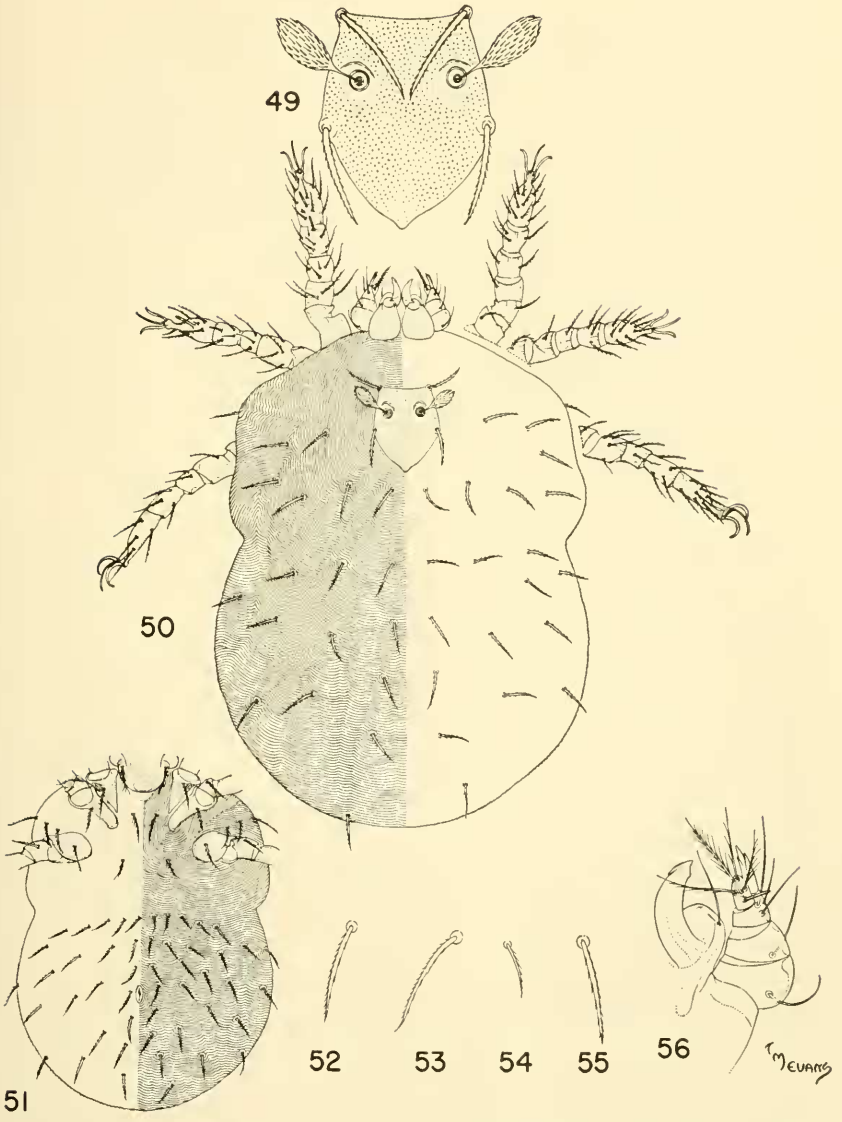
STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AL	PL	DS	PP	PW / Cox. II	PW / SD	PW / ASB	PW / Tars. III
Holotype (B-24925-1)	43	49	35	23	49	39	33	33	30	33	49/50 = 0.92	0.68	2.1	49/51 = 0.96
Paratypes (10) Mean	44	50	36	25	48	41	32	32	30	32	0.91	0.68	2.0	0.95
Range (+or—)	4	3	2	2	3	3	4	4	2	3	0.06	0.05	0.1	0.07

Body Setae: Dorsal setae resembling scutal setae; about 36-38 in number; frequently arranged 4-8. . . , the rest irregular so that some rows have two or four setae out of line. Ventral setae about 54 in number, of which about 18 are postanals, but these not much differentiated from true ventrals, although somewhat longer. True ventrals about 21 microns in length; thin; pinnae sparse and short.

Legs: Coxae each with 1 seta; in coxa III it is submedian in position. With 1, 2, or 3 ventral setae inserted anterior to coxa III; near anterolateral angle; one of these setae may be near lateral margins of body. Sternal setae 2-2. Sensory setae as typical for genus.

Type Material.—Holotype and 13 paratypes (RT B-24925) *ex* the reed vole, *Microtus fortis pelliceus* Thomas, Korea, Taegwang-ni, 7 miles SW of Ch'orwon, 19 August 1953, coll. Field Unit of the Commission on Hemorrhagic Fever (U. S. Army), as were others in type series. One hundred and seven other paratypes, all from Korea, as follows: 5 *ibid*, but 10 November 1953; 7 *ex* the Old World or striped field mouse *Apodemus agrarius, ibid,* 12 September 1953; 4 *ex Microtus fortis pelliceus,* Munsan-ni, 6 November 1953; 1 *ex* same locality and date but from the Korean hamster, *Cricetulus triton nestor* Thomas; 20 *ex* 4 specimens of *Cricetulus triton nestor*, Ori-dong, as follows—eleven, 7 October 1952; five, 22 August 1952; six, 13 September 1952; three, 20 September 1952; 9 *ex* 3 hamsters at Kumhwa—two, 9 September 1952; six, 5 August 1952; one, 29 June 1952; 21 *ex* a hamster of Chong'gong-ni, 16 September 1952; 15 *ex* 2 hamsters, Yonch'on—thirteen, 29 August 1952; two, 4 October 1952; 9 *ex Apodemus agrarius*, Seoul, August 1951; 1 ex *Microtus fortis pelliceus*, Chip'o-ri, 5 June 1952; 1 *ex* a *Mus* at Yonch'on, 15 December 1952; 2 *ex* a mole, *Talpa* sp., at Yangwon-ni, 20 April 1953; 4 *ex* a hamster, *Yongp'yong*, 20 October 1953 and 1 *ex* the Korean redbacked vole,



G. (Walchia) comataxilla, n. sp. Fig. 49, scutum; fig. 50, dorsal view of larva (ventral aspect of legs); fig. 51, ventral view of larva; fig. 52, humeral seta; fig. 53, dorsal seta; fig. 54, preanal seta; fig. 55, postanal seta; fig. 56, gnathosoma (dorsal).

Clethrionomys rufocanus regulus, Yongp'yong, 14 April 1954; 1 from *Microtus fortis pelliceus,* Yangwon-ni, 3 September 1953.

Holotype (U.S.N.M. No. 2236) deposited in U. S. National Museum, and paratypes distributed as for *T.* (*L.*) *gemiticula,* n.sp.

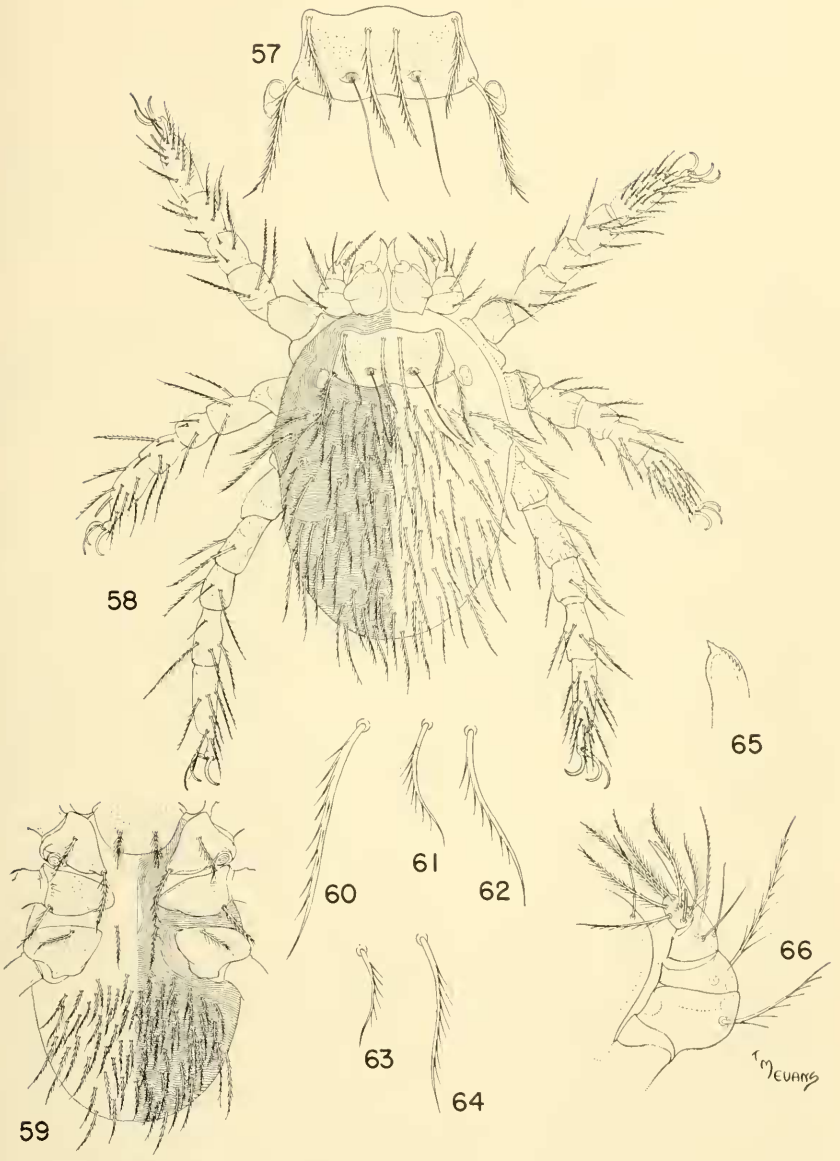
Comment.—Over 90% of the specimens of *G.*(*W.*) *comataxilla* were collected from the hamster, *Cricetulus.* Since several hundred mice trapped among the lush moist vegetation bordering streams at Yonch'on and Chip'o-ri were not infested with this chigger, it is believed that *G.*(*W.*) *comataxilla,* n.sp., is most apt to be found on the relatively dry, rocky slopes of hillsides, the type of terrain characteristically inhabited by *Cricetulus.* Nearly two-thirds of the specimens were collected during the summer months, a relatively dry period of the year.

Even when present, *G.*(*W.*) *comataxilla* generally constituted a minority of the chiggers sampled. Frequently less than 10% of the chiggers on these particular hosts were this species, but in one instance 25 of 45 identified from a *Cricetulus* were *G.*(*W.*) *comataxilla.*

Shunsennia hertigi, n. sp.
(Figs. 57-66)

Diagnosis.—Nearest to *Shunsennia biplumulosa* Teller, 1956, but readily separable as follows: Coxae II and III with one seta instead of two; palpal setal formula B/B/BNN instead of B/B/NBB; as well as by significant differences in standard measurements and sensory setae. Separable from the genotype *S. tarsalis* Jameson and Toshioka, 1953, as follows: 1) With a distinct subapical row of teeth on the chelicerae (fig. 65) which is absent in *S. tarsalis* (fig. 74). 2) Scutum with posterior margin sinuate (fig. 57), not convex (fig. 67). 3) Scutum about twice as broad as long, at maxima, instead of about 1½ times as broad. 4) Eyes double (fig. 57), not single (fig. 67). 5) Lateral and ventral tibial setae of palpus nude (fig. 66), not branched (fig. 74). 6) Palpal thumb with 6 setae instead of 7. 7) Galeal seta nude instead of barbed. 8) Palpal claw bifid, not trifid. 9) Leg I with a tarsal parasubterminala, which is lacking in *S. tarsalis.* 10) Leg II lacking the tarsal microspur and pretarsala of *S. tarsalis.* 11) Leg III with a genuala but lacking the tarsal spur. Instantly separable from *S. ochotona* (Radford, 1942) by virtue of characters 1, 2, 5, 7, among others.

Description.—**Body:** Very long and subovate, 513 x 302 microns in moderately engorged holotype. Eyes double; anterior one larger; just posterior to level of insertion of *PLs.* **Gnathosoma:** Chelicerae about ⅜ as long as broad at base; with subapical row of very small teeth immediately proximad to the cheliceral cap. Seta on palpal femora branched; seta on genu nearly twice as long as femoral seta, subpectinate; dorsal tibial seta branched; the lateral and ventral tibial setae nude; palpal formula therefore B/B/BNN. Palpal tarsus with 6 branched setae and a basal striated rod. Palpal claw 2-pronged. Chelicerae bases, palpal coxae, and femora punctate. Coxal setae (maxillary setae) branched, inserted somewhat medially on palpal coxa. **Scutum:** Slightly more than twice as broad as long. Anterior margin biconcave. Lateral margins straight except for rounded "shoulders." Posterior margin biconvex, with a deep median sinus. The two *AMs* inserted at level slightly posterior to insertions of *ALs.* Scutum



Shunsennia hertigi, n. sp. Fig. 57, scutum; fig. 58, dorsal view of larva (with ventral aspect of legs); fig. 59, ventral view of larva; fig. 60, humeral seta; fig. 61, dorsal seta; fig. 62, dorsal seta; fig. 63, preanal seta; fig. 64, postanal seta; fig. 65, chelicera; fig. 66, palp and galea (ventral view).

very lightly micropunctate except around *AMs* and posterior to sensillae bases. Sensillary bases on same level as *PLs* or just slightly anterior. Sensillae flagellate, nude for entire length. A darkened ridge just anterior to bases.

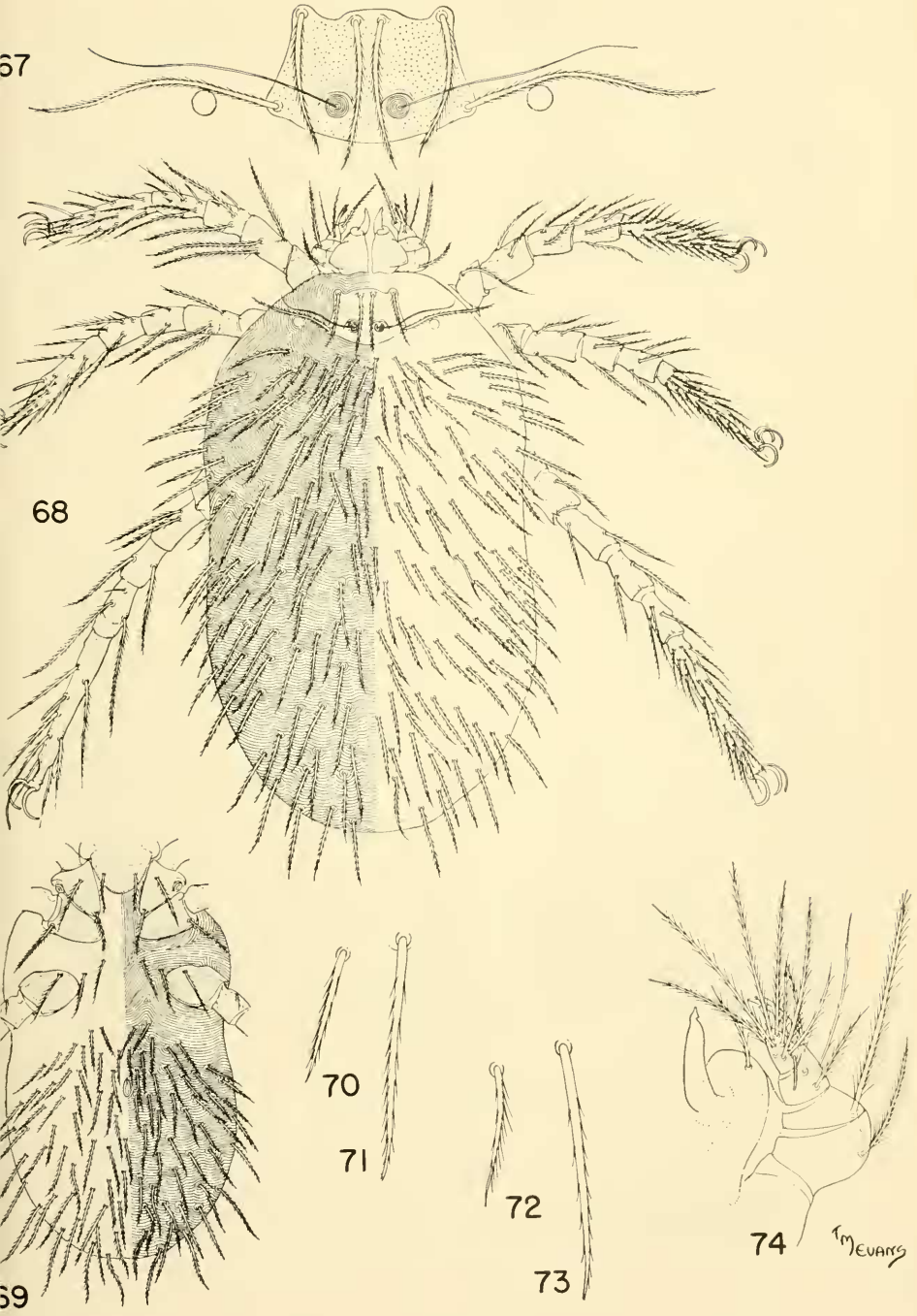
STANDARD MEASUREMENTS IN MICRONS

	AW	PW	SB	ASB	PSB	A-P	AM	AL	PL	DS	PW Cox. II	PW SD	PW ASB	PW Tars. III
Holotype (B-28722)	90	115	43	43	16	41	86	81	77	44 -93	115 —=1.44	1.95	2.56	1.28
Paratypes (9)														08
Mean	90	116	43	44	17	41	79	78	82	39 -100	1.44	1.90	2.61	1.34
Range (+or—)	5	7	1	3	3	4	7	12	8		0.08	0.23	0.3	0.06

Body Setae: Dorsal setae thinner than and not quite as plumose as scutal setae, varying in length from 39 to 100 microns with shortest setae in middle of first row. Humeral seta usually closely associated with displaced setae of first dorsal row, posteriorwards on each side so as to be inserted immediately anterior to outermost 2 setae of first dorsal row. Humeral setae and lateral-most of first row the longest of the dorsal setae. Dorsal setae ranging in number from 81 to 98; variable in arrangement of rows; with from 14 to 21 setae in first row; those in second row irregular, at times appearing as distinct rows. Only one pair of sternal setae present; inserted midway between coxae II and III; about 70 microns long. Ventral setae about 80 in number; 35-40 microns long in the first few rows behind 3rd coxae. Anal aperture relatively anterior in position, between 3rd and 4th row of ventral setae, so that nearly half of ventral setae are postanals. **Legs:** Coxae and legs finely punctate. First coxa with 2 setae, one almost median; the other in mesocaudal angle. Coxa II unisetose; seta inserted in the posterolateral angle. Coxa III unisetose; seta anteromarginal. Sensory setae as follows: Leg I with 2 genualae, microgenuala, 2 tibialae, microtibiala, tarsal spur, microspur, subterminala, parasubterminala, pretarsala; leg II with a genuala, microgenuala, 2 tibialae, a tarsal spur, a pretarsala; leg III with a genuala and a tibiala. Tarsi with 2 claws and a claw-like empodium.

Type Material.—Holotype (RT B-28722) *ex Apodemus peninsulae* Korea, Sangbonch'on-ni, 17 miles SE of Seoul, 28 May 1954, coll. Field Unit of the Commission on Hemorrhagic Fever (U. S. Army). The following 12 paratypes were all collected in Korea by the same field unit: 3 *ex Apodemus agrarius*, Nop'a-dong, 7 miles NW of Munsan-ni, 24 February 1954; 1 *ex Apodemus agrarius*, Yongp'yong, 16 miles S of Ch'orwon, 2 March 1954; 2 *ex Apodemus agrarius*, Munsan-ni, 6 and 7 November 1953; 3 *ex Clethrionomys rufocanus regulus*, Camp Indianhead, 2¾ miles E of Yangwon-ni, 17 September 1953; 3 from Sangbonch'on-ni—1 *ex Apodemus agrarius*, 14 April 1954; 1 *ex Apodemus peninsulae*, 14 April 1954; 1 *ex Apodemus peninsulae*, 14 April 1954; 1 *ex Apodemus agrarius*, 16 February 1954. Holotype (U.S.N.M. No. 2237) deposited in U. S. National Museum.

Shunsennia tarsalis J. and T. Fig. 67, scutum; fig. 68, dorsal view of larva (with ventral aspect of legs); fig. 69, ventral view of larva; fig. 70, dorsal seta; fig. 71, dorsal seta; fig. 72, preanal seta; fig. 73, postanal seta; fig. 74, gnathosoma.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T.M. EVANS

Paratypes distributed amongst collections of the Rocky Mountain Laboratory of the U. S. Public Health Service, the Colonial Office Research Unit at Kuala Lumpur, the Department of Entomology, University of Kansas, and the authors.

Comment.—As can be seen from the diagnosis, *S. hertigi* differs rather considerably from the genotype, and in some respects suggests *Chatia* Brennan, 1946, although distinct from that genus. Since the higher classification of trombiculid mites needs considerable study, it is felt advisable to treat this interesting species as a *Shunsennia*.

This species is named for Dr. Marshall Hertig, Director of the Commission on Hemorrhagic Fever of the Armed Forces Epidemiological Board, whose work in medical entomology at the Gorgas Memorial Laboratory in Panama was interrupted for several years while he served as Director of the Field Unit in Korea.

ACKNOWLEDGEMENTS

We are grateful to Dr. Joseph E. Smadel, former Director of the Division of Communicable Diseases, Walter Reed Army Medical Center, Washington, and to Dr. Marshall Hertig, of the Gorgas Memorial Laboratory, Panama, both of whom served as Directors of the Commission on Hemorrhagic Fever of the Armed Forces Epidemiological Board and as leaders of the Field Units in Korea, and who made it possible to collect and study these trombiculid mites. Our debt to various Army installations for their unstinted cooperation is great, and since these organizations are listed in detail elsewhere (Traub *et al., in prep.*), we here merely express our thanks. Although two of the authors (R.T. and L.J.L.) served in Korea, the large numbers of specimens available for study were obtained only by the enthusiastic assistance of the officers and men of the field teams, particularly T. T. Harriss, W. H. Lawrence, William Barnes, James J. O'Keefe, and Ervin Kardos. Dr. E. W. Jameson, Jr., and Dr. Paul Oman, formerly of the 406th Medical General Laboratory in Tokyo, and Dr. J. R. Audy, of the Institute for Medical Research, Kuala Lumpur, Malaya, were especially helpful in loaning specimens for comparison. Thanks are also due Thomas M. Evans, of the Department of Entomology, Walter Reed Army Institute of Research, who prepared the illustrations for this paper. Gordon Marsh, of that institution, greatly assisted in the identification of thousands of Korean chiggers, including some of the new species herein described.

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